# *In-situ* High Temperature Phase Transformations in Oxide Ceramics

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## Introduction

High temperature phase transformations in oxide ceramics are being studied in-situ, in air, using a thermal-image furnace in conjunction with synchrotron radiation. The emphasis is on oxide materials exhibiting polymorphic phase transformations, especially of ferroelastic nature, at elevated temperatures.

Information on detailed mechanisms of crystal structure changes in true ferroelastic phase transformation in selected materials is expected to aid in designing tough, high temperature composites, large force actuators and shape memory ceramics.

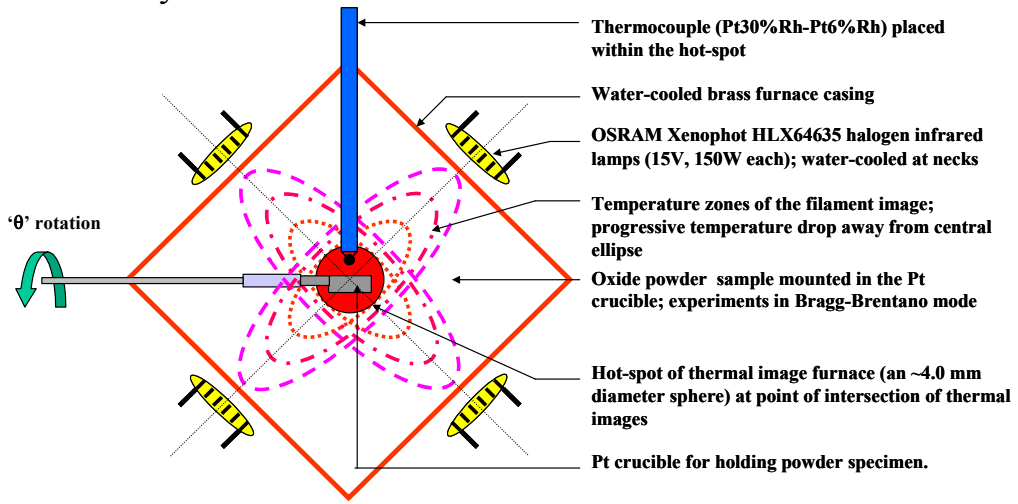


Fig. 1. Schematic of thermal image furnace setup to conduct high temperature phase transformation studies *in-situ*, in Bragg-Brentano geometry.

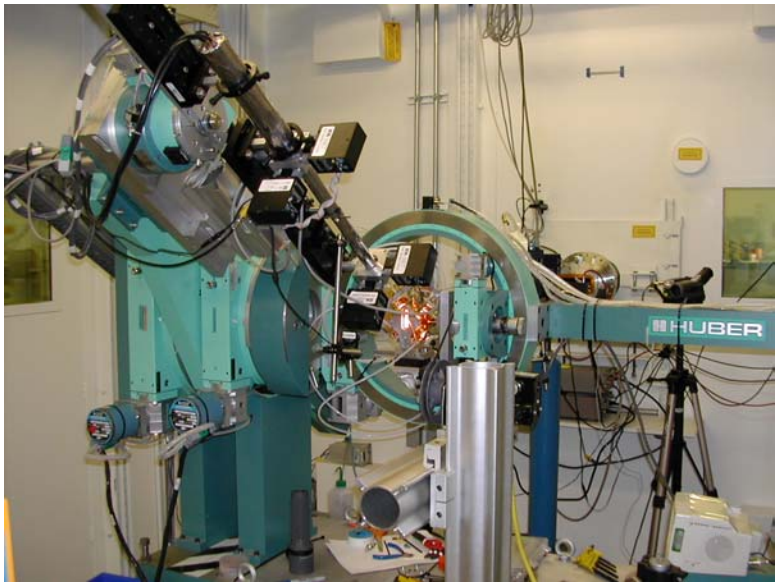


Fig. 2. Furnace in operation at the Advanced Photon Source (APS), Argonne National Laboratory, Argonne, IL

## Accomplishments:

- Fully operational reflection mode setup for conducting in situ high temperature XRD studies
- Extensive experimental verification of in situ temperature measurement using Pt and MgO
- Independent setup at APS and NSLS
- Preliminary experimental studies on $Ta_2O_5$

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**Education:**

Four undergraduates (Jared Chaney, Brian Becker, Dan Berowski and Melissa Smith), one graduate student (Ms. Lay Foong Siah), and one postdoc (Pankaj Sarin) contributed to this work. Undergraduate Ms. Melissa Smith, an African American woman, received a UIUC IMPRINT (summer of 2002 intern) scholarship to work as an incoming freshman student under the direction of Professor Kriven and her group. Ms. Lay Foong Siah received her Ph. D. in 2002 and is presently working as a research scientist at SIRIM Berhad, in Malaysia.

**Outreach:**

With undergraduate student Melissa, the PI demonstrated preparation of oxide ceramic powders. Melissa joined the group while still a Junior in high school and has been working with Prof. Kriven since 2000. She is a sophomore student in the MatSE Dept.